

Title: The SIRTf Wide-area InfraRed Extragalactic Survey (SWIRE)
--- Exploring the dark side of galaxy evolution

Authors: C.K. Xu, C. Lonsdale (PI), M. Rowan-Robinson, H.E. Smith,
T. Conrow, F. Fang, A. Franceschini,
N. Gautier, M. Griffin, P. Hacking, F. Masci, G. Morrison,
J. Olinger, S. Oliver, F. Owen, D. Padgett, I. Perez-Fournon,
M. Pierre, R. Puetter, D. Shupe, G. Stacey, J. Surace
S. Serjeant, H. Dole, M. Werner, J. Condon, D. Frayer

Category: 18 (Evolution of Galaxies, Galaxy Surveys)

SWIRE, the largest SIRTf Legacy program, is a wide-area, imaging survey of infrared galaxies and AGNs. It will survey 7 high-latitude fields, 65 sq. deg. in total, in all 7 SIRTf bands to the 5-sigma sensitivity limits of $f(3.6\mu\text{m})=7.3 \text{ uJy}$, $f(4.5\mu\text{m})=8.7 \text{ uJy}$, $f(5.8\mu\text{m})=27.5 \text{ uJy}$, $f(8.0\mu\text{m})=32.5 \text{ uJy}$, $f(24\mu\text{m})=0.45 \text{ mJy}$, $f(70\mu\text{m})=2.75 \text{ mJy}$, and $f(160\mu\text{m})=17.5 \text{ mJy}$. The key scientific goals of SWIRE are to enable fundamental studies of cosmology and galaxy formation in the mid- and far-infrared, for the key redshift range $0.5 < z < 2.5$ where much of cosmic evolution has occurred: (1) The evolution of both actively star-forming and passively-evolving galaxies to determine the history of galaxy formation (including the global Star Formation History - SFH), in volumes large enough to place this in the context of cosmic structure formation and galaxy environment. (2) The spatial distribution and clustering of evolved galaxies, starbursts, and AGN, and the evolution of their clustering in the redshift range $0.5 < z < 2.5$. (3) The evolutionary relationship between galaxies and AGN, and the contribution of AGN accretion energy to the cosmic backgrounds, relative to that from nucleosynthesis.

In order to better define our science goals as well as to aid the survey planning, we have developed sophisticated empirical models for the evolution of infrared galaxies and AGNs. Exploiting a large SED library which covers a very wide wavelength range, these models can predict counts and colors in various wavebands, including the UV, optical, NIR, MIR, FIR, sub-mm, and radio. Comparing these predictions with data taken from available surveys such as IRAS, ISO, SCUBA, and the HST deep surveys in the optical and NIR, the parameters in the models can be tightly constrained. According to these models, the SWIRE survey will be dominated by: (1) more than 100,000 luminous infrared galaxies ($L_{\text{fir}} > 10^{11} L_{\text{sun}}$); up to 10,000 with $z > 2$. (2) nearly 1 million early-type galaxies; up to 10,000 with $z > 2$. (3) 26,000 classical AGN, and as many as 130,000 dust-obscured QSO/AGN. Our best-fit model also predicts the following 3-sigma confusion limits: $f(3.6\mu\text{m})=0.10 \text{ uJy}$, $f(4.5\mu\text{m})=0.19 \text{ uJy}$, $f(5.8\mu\text{m})=0.39 \text{ uJy}$, $f(8.0\mu\text{m})=0.99 \text{ uJy}$, $f(24\mu\text{m})=0.06 \text{ mJy}$, $f(70\mu\text{m})=6.35 \text{ mJy}$, and $f(160\mu\text{m})=82.5 \text{ mJy}$. Accordingly, the SWIRE survey will be confusion limited in the 70um and 160um bands.